Claims

1. A vaccine composition comprising an antigen bearing target and further comprising a fusion polypeptide, said fusion polypeptide comprising

   a first amino acid sequence which can bind to a carbohydrate and

   a second amino acid sequence comprising a ligand for a cell surface polypeptide, said ligand being chosen from the group: a ligand for a cytokine receptor, a ligand for CD40, a ligand for an adhesion molecule, a ligand for a defensin receptor, a ligand for a heat shock protein receptor, a ligand for a T cell costimulatory molecule, a ligand for a counterreceptor for a T cell costimulatory molecule.

2. The vaccine composition of claim 1, wherein said antigen bearing target comprises at least one of the following: a tumor antigen, a viral antigen, a bacterial antigen, a fungal antigen, a parasite antigen, a prion antigen, an antigen of an autoimmune disease.

3. The vaccine composition of claim 1, wherein said antigen bearing target is chosen from the group: a tumor cell, a virus, a bacterial cell, a fungal cell, a cell of a parasite, a prion, a mammalian cell, an insect cell, a polypeptide free of other cell-derived material.

4. The vaccine composition of claim 2, wherein said antigen bearing target is pathogenic.

5. The vaccine composition of claim 2, wherein said antigen bearing target is attenuated.

6. The vaccine composition of claim 1, wherein said antigen bearing target is a cell which is substantially unable to divide.

7. The vaccine composition of claim 2, wherein said antigen bearing target is a cell and said fusion polypeptide is exogenous to said cell.

8. The vaccine composition of claim 2, wherein said antigen bearing target is a cell and said fusion polypeptide is endogenous to said cell and is encoded by a nucleic acid sequence comprised by the cell.

9. The vaccine composition of claim 1, wherein said first amino acid sequence is N-terminal to said second amino acid sequence.

10. The vaccine composition of claim 1, wherein said first amino acid sequence is C-terminal to said second amino acid sequence.

11. The vaccine composition of claim 1, wherein said first amino acid sequence can bind to a sialic acid on a glycoprotein, said sialic acid comprising at least one of the following carbohydrate structures: N-acetylneuraminic acid, alpha-NeuNAc-[2->6]-Gal, alpha-NeuNAc-[2->6]-GalNAc, alpha-NeuNAc-[2->3]-Gal.

12. The vaccine composition of claim 1, wherein said first amino acid sequence comprises a carbohydrate-binding domain of a naturally occuring lectin.

13. The vaccine composition of claim 1, wherein said first amino acid sequence comprises at least about 10 contiguous amino acids of a hemagglutinin.

14. The vaccine composition of claim 12, wherein said hemagglutinin is an influenza virus hemagglutinin.

15. The vaccine composition of claim 13, wherein said contiguous amino acids of an influenza hemagglutinin are contiguous amino acids of an influenza hemagglutinin HA1 domain.

16. The vaccine composition of claim 14, wherein said influenza virus is an influenza A virus.

17. The vaccine composition of claim 15, wherein said influenza virus is of a subtype that infects humans.

18. The vaccine composition of claim 15, wherein said influenza virus is of an H1 subtype.

19. The vaccine composition of claim 17, wherein said influenza virus is from the strain A/PR/8/34.

20. The vaccine composition of claim 15, wherein said influenza virus is of an H2 or H3 subtype.

21. The vaccine composition of claim 15, wherein said influenza virus is of a subtype that does not infect humans.

22. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mammalian cell surface polypeptide.

23. The vaccine composition of claim 21, wherein said ligand for a cell surface polypeptide is a ligand for a mouse cell surface polypeptide.

24. The vaccine composition of claim 21, wherein said ligand for a cell surface polypeptide is a ligand for a human cell surface polypeptide.

25. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a leukocyte.

26. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of an antigen presenting cell.

27. The vaccine composition of claim 26, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a professional antigen presenting cell.

28. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a cell surface polypeptide of a dendritic cell.

29. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse GM-CSF receptor.

30. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse GM-CSF.

31. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse GM-CSF.

32. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human GM-CSF receptor.

33. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human GM-CSF.

34. The vaccine composition of claim 1,wherein said ligand for a cell surface polypeptide comprises a human GM-CSF.

35. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interleukin.

36. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interleukin.

37. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interleukin.

38. The vaccine composition of claim 35, wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

39. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interleukin.

40. The vaccine composition of claim 39 wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

41. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises an interleukin.

42. The vaccine composition of claim 41 wherein said interleukin is chosen from the group: IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, IL-21, IL-22, IL-23, IL-24, IL-25.

43. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a chemokine.

44. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse chemokine.

45. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human chemokine.

46. The vaccine composition of claim 43, wherein said chemokine is a C-C cytokine.

47. The vaccine composition of claim 43, wherein said chemokine is a C-X-C cytokine.

48. The vaccine composition of claim 43, wherein said cell surface polypeptide is chosen from the group: CXCR-1, CXCR-2, CXCR-3, CXCR-4, CCR-1, CCR-2, CCR-3, CCR-4, CCR-5, CCR-6, CCR-7, CCR-8.

49. The vaccine composition of claim 43, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

50. The vaccine composition of claim 43, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of a chemokine.

51. The vaccine composition of claim 50, wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

52. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a chemokine.

53. The vaccine composition of claim 52 wherein said chemokine is chosen from the group: 9E3, AMCF, beta-thromboglobulin, ENA-78, eotaxin, eotaxin-2, IP-10, KC, LIX, mig, MGSA, mob-1, NAP-2, NAP-3, NAP-4, PBSF, MGSA, mouse KC, MIP-2, MIP-1 alpha, NAP-2, ENA-78, GCP-2, ACT-2, C10, CCF18, DC-CK1, ELC, Exodus, FIC, GDCF, GDCF-2, HC-21, HCC-1, I-309, JE, LAG-1, MARC, MCAF, MCP-1, MCP-2, MCP-3, MCP-4, MCP-5, MRP-2, RANTES SDF, TARC, ATAC, Ltn, SCM-1, neurotactin.

54. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for an interferon.

55. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a mouse interferon.

56. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a receptor for a human interferon.

57. The vaccine composition of claim 54, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

58. The vaccine composition of claim 54, wherein said ligand for a cell surface polypeptide comprises at least about 5 contiguous amino acids of an interferon.

59. The vaccine composition of claim 58, wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

60. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises an interferon.

61. The vaccine composition of claim 60 wherein said interferon is chosen from the group: an interferon-alpha, an interferon-beta, an interferon gamma.

62. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse TNF-alpha receptor.

63. The vaccine composition of any of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse TNF-alpha.

64. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse TNF-alpha.

65. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human TNF-alpha receptor.

66. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human TNF-alpha.

67. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a human TNF-alpha.

68. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a mouse flt-3 receptor.

69. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a mouse flt-3.

70. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a mouse flt-3.

71. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide is a ligand for a human flt-3 receptor.

72. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises at least about five contiguous amino acids of a human flt-3.

73. The vaccine composition of claim 1, wherein said ligand for a cell surface polypeptide comprises a human flt-3.

74. The vaccine composition of claim 1, wherein said fusion polypeptide further comprises a linker interposed between said first and second amino acid sequences.

75. The vaccine composition of claim 74, wherein said linker has the formula $(Gly_xSer)_n$, wherein n is an integer between 1 and 15, and x is an integer between 1 and 10.

76. The vaccine composition of claim 1, which comprises said fusion polypeptide bound to a carbohydrate on said antigen bearing target.

77. The vaccine composition of claim 1, in which at least some of said fusion polypeptide is not bound to said antigen bearing target.

78. The vaccine composition of claim 1, wherein said antigen bearing target is a cell and said vaccine composition comprises said fusion polypeptide bound to a carbohydrate on the surface of said cell.